



## **Current status and prevalence of bacterial blight disease of cotton in India**

A. SAMPATH KUMAR\*, K. ERAIVAN ARUTKANI AIYANATHAN, S. NAKKEERAN AND S. MANICKAM

**Department of Plant Pathology, Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore - 641 003**

**\*E-mail : [sampath000@gmail.com](mailto:sampath000@gmail.com)**

**ABSTRACT :** A detailed survey was conducted for the occurrence and prevalence of cotton bacterial blight disease in three major cotton growing regions of India during the crop seasons 2015-2016 and 2016-2017. The prevalence of bacterial blight disease was observed in all the cotton growing tracts and the incidence was varied from 3 to 42 per cent with an average of 15.09 per cent across the surveyed locations of India. The highest disease incidence was recorded in Central zone (Maharashtra) and it was ranged from 12 to 42 per cent with an average of 21 per cent. Among the different surveyed areas in Central zone, the maximum incidence of 42 per cent was observed in Nagpur. The disease incidence ranged from 13 to 22 per cent with an average of 18.20 per cent in north zone (Punjab). In south zone (Telangana, Andhra Pradesh, Karnataka and Tamil Nadu), 3 to 23 per cent disease incidence was recorded. The maximum incidence of 23 per cent was noticed in Dharwad region of Karnataka in South zone. The disease incidence was low in the states of Telagana and Andhra Pradesh (7 to 14%) and very low in Tamil Nadu (3 to 12%) compared to Karnataka (9 to 23%). Most of the bacterial blight symptoms such as angular leaf spot, vein blight, petiole blight and black arm were observed in all the three surveyed zones of India. The boll rot symptom was observed only in Nagpur region of Maharashtra state in Central zone.

**Key words :** Bacterial blight, cotton, *Xanthomonas citri* pv. *malvacearum*

Cotton (*Gossypium* spp.) is an important natural fibre for textile industry. The cotton crop is affected by several diseases from seedling to maturity by various agents like fungi, bacteria and virus. The favourable weather conditions play a major role in disease occurrence among various cotton growing zones of India. Bacterial blight caused by *X. citri* pv. *malvacearum* (*Xcm*) is the major disease occurring in entire cotton growing regions of India. The disease was considered as one of the world's most widely distributed cotton diseases. Five stages of the

disease are recognized based on the symptoms and area of infection in the plant namely seedling blight, angular leaf spot, vein blight, black arm and boll rot. Typical symptoms of the disease on susceptible cotton genotypes are water-soaked lesions, angular leaf spots, black arm and boll rot (Madani *et al.*, 2010). Under favourable conditions, yield loss can exceed 50 per cent. Cotton fields infected with bacterial blight have been found to show as much as 80 per cent yield loss in certain areas (Jalloul *et al.*, 2015). Reports of the occurrence of bacterial blight disease in

natural field conditions ranged from 19 to 38 per cent in different cotton growing areas of India. This difference in the intensity of bacterial blight disease in various cotton growing areas necessitated to undertake an extensive survey to assess the bacterial blight incidence in three major cotton growing zones of India and to observe the severity of the disease with different types of symptoms.

### MATERIALS AND METHODS

The survey on the incidence of bacterial blight disease of cotton was carried out in three cotton growing zones of India with six different states namely Punjab (North zone), Maharashtra (Central zone), Tamil Nadu, Karnataka, Andhra Pradesh and Telangana (South zone) during the crop seasons of 2015–2016 and 2016–2017. Different types of bacterial blight symptoms were recorded during the survey in boll formation and maturity stage of the crop, specifically 100 day after sowing. The bacterial blight scoring was performed using 0-4 disease rating scale according to Sheo Raj (1988). The Per cent disease index (PDI) was calculated using the following formula.

$$\text{Per cent (PDI \%)} = \frac{\text{Sum of all numerical ratings}}{\text{Total number of leaves observed}} \times \frac{100}{\text{Maxmium grade}}$$

### RESULTS AND DISCUSSION

The varied level of bacterial blight incidence was recorded and it was ranging from 3 to 42 per cent across the three surveyed cotton growing zones of India. The highest disease

incidence was recorded in central zone (Maharashtra) which ranged from 12 to 42 per cent with an average of 21 per cent in the three surveyed districts such as Nagpur, Akola and Rahuri (Table 1). The maximum incidence of 42 per cent was recorded in Nagpur district of Maharashtra in central zone. The results are in accordance with the survey records of All India Coordinated Cotton Improvement Project (AICCIP) annual reports (2012-2013). The disease incidence ranged from 21.25 to 22.08 per cent was recorded in Akola district of Maharashtra and 3.50 to 29.75 per cent among various hybrids and varieties grown in Nanded district of Maharashtra during 2013-2014 crop seasons (AICCIP annual report, 2013-2014). Jagtap *et al.*, (2012) conducted survey on cotton bacterial blight incidence in Marathwada region of Maharashtra and recorded the average PDI of 51.12 per cent among six surveyed districts and the incidence was found to be higher than the present study results. They also recorded highest disease incidence in Parbhani district (67%) followed by Hingoli (63%), Nanded (58%) and Latur (54%). The lowest was recorded in Jalna district (36%). Sandipan *et al.*, (2016) recorded 15 and 30 per cent of bacterial blight incidence in susceptible cultivars *viz.*, Surat dwarf and LRA 5166, respectively in the survey conducted in south Gujarat region. The incidence of bacterial leaf blight was ranged from 1 to 15, 0 to 12.5 and 2 to 3 per cent in Surat, Bharuch and Narmada districts of Gujarat, respectively (AICCIP annual report, 2016-2017) and 7 to 11 per cent in Junagadh region of Gujarat (AICCIP annual report, 2017-2018) in different cultivars grown in farmer's fields. The total cultivated area (100%) in Australia was occupied by bacterial

blight susceptible cultivars during 1984.

The bacterial blight incidence of 13 to 22 per cent was recorded in the surveyed districts such as Faridkot and Bathinda in north zone of Punjab. But only 0.10 to 3 per cent bacterial blight incidence was recorded in Faridkot, Fazilka and Muktsar districts of Punjab during 2017-2018 (AICCIP annual report, 2017-2018).

The disease incidence observed in south zone (Telangana, Andhra Pradesh, Karnataka and Tamil Nadu) was ranged between 3 and 23 per cent and this is in corroboration with the earlier report, where the bacterial blight incidence was ranged from 10 to 25 per cent in South zone (AICCIP annual report, 2015-2016). In the present study, maximum of 23 per cent incidence was recorded from Dharwad region of Karnataka, which is lower than the previous reports. *i.e.* bacterial blight incidence of 5- to 35 per cent was recorded in Dharwad region of Karnataka (AICCIP annual report, 2014-2015). The disease incidence was low in the States of Telangana and Andhra Pradesh (7 to 14%) and very low in Tamil Nadu (3 to 12%) compared to Karnataka (9 to 23%). This revealed the influence of geographical, environmental factors and host specificity on the bacterial blight incidence of cotton.

In the present survey, the typical bacterial blight symptoms were observed during boll formation and maturity stage of the crop, specifically 100 day after sowing (Table 1). Initially small, water soaked lesions appeared on the lower surface of the leaves. Later, on both the surface of the leaves, brown to black colour spots were developed. Spots were angular to irregular in shape. As the disease progressed, these spots also grew, increased in size. After,

the pathogen spread to veinal region, caused vein blight. With the advancement of disease, the pathogen spread to petiole and caused petiole blight. Severely infected plants produced black arm symptoms on stem portion of the plants. Similar type of bacterial blight symptoms have been reported by many earlier workers. Reports revealed that the occurrence of bacterial blight at any stage in the plant's life cycle and on any aerial organ. The symptoms included seedling blight as either pre or post-emergent damping-off, black arm on petioles and stems, water-soaked spots on leaves and bracts and most importantly boll rot. Typical disease symptoms such as seedling blight, angular leaf spot, vein blight, black arm and boll rot based on different plant parts infected with the bacterium were also observed. The various types of symptoms of bacterial blight of cotton were observed in matured plants in the field grown crops (Essenberg *et al.*, 2014).

Severe symptoms of angular leaf spot, vein blight, petiole blight, black arm and boll rot were observed in the Nagpur region of Maharashtra during the survey. In Punjab, moderate disease incidence was observed with angular leaf spot, vein blight and petiole blight. In Tamil Nadu, moderate to low amount of bacterial blight symptoms were observed predominantly as angular leaf spot and few places as vein blight. The moderate to severe form of vein blight symptoms were recorded in Dharwad region of Karnataka. The boll rot symptoms were not observed in other places except Nagpur region. Infection in corolla spread to cotton flower buds, young bolls, and cause premature boll shedding.

Table 1. Cotton bacterial blight incidence in different cotton growing regions of India

S.No	State	District	Variety/Hybrid	GPS		PDI	Symptoms Observed
				Latitude	Longitude		
1	Maharashtra	Nagpur	Suraj (V)	21° 02' 10"	79° 03' 22"	42.0	ALS, VB, PB, BA and BR
2	Maharashtra	Nagpur	Suvin (V)	21° 02' 10"	79° 03' 22"	29.0	ALS, VB, PB and BA
3	Maharashtra	Nagpur	DCH 32 (H)	21° 02' 10"	79° 03' 22"	24.0	ALS, VB, PB, BA and BR
4	Maharashtra	Nagpur	RCH 2 BG II (H)	21° 02' 10"	79° 03' 22"	15.0	ALS and VB
5	Maharashtra	Nagpur	NH 615 (V)	21° 02' 10"	79° 03' 22"	18.0	ALS, VB and PB
6	Maharashtra	Nagpur	Ankur 3034 BG II (H)	21° 02' 10"	79° 03' 22"	15.0	ALS, VB and PB
7	Maharashtra	Akola	Bunny Bt (H)	20° 42' 02"	77° 02' 13"	12.0	ALS and VB
8	Maharashtra	Akola	AK 081 (V)	20° 42' 02"	77° 02' 13"	23.0	ALS, VB, PB, BA and BR
9	Maharashtra	Rahuri	Ajit 199 Bt (H)	19° 20' 57"	74° 38' 09"	17.0	ALS and VB
10	Maharashtra	Rahuri	NT-Br-02-532 (Culture)	19° 20' 57"	74° 38' 09"	15.0	ALS, VB and PB
11	Punjab	Bathinda	HS 6 (V)	30° 11' 08"	74° 56' 52"	21.0	ALS, VB and PB
12	Punjab	Faridkot	NCS 855 BG II (H)	30° 40' 31"	74° 44' 56"	13.0	ALS
13	Punjab	Faridkot	Ankur 3028 Bt (H)	30° 40' 31"	74° 44' 56"	22.0	ALS, VB and PB
14	Punjab	Faridkot	Bioseed 6588 BG II (H)	30° 40' 31"	74° 44' 56"	16.0	ALS and VB
15	Punjab	Faridkot	F-846 (V)	30° 40' 31"	74° 44' 56"	19.0	ALS and VB
16	Karnataka	Dharward	Suvin (V)	15° 27' 36"	75° 02' 47"	23.0	ALS, VB, PB and BA
17	Karnataka	Dharward	RHB 1005 (V)	15° 27' 36"	75° 02' 47"	9.0	ALS
18	Karnataka	Dharward	GSB 41 (V)	15° 27' 36"	75° 02' 47"	18.0	ALS, VB and PB
19	Karnataka	Dharward	Bunny Bt (H)	15° 27' 36"	75° 02' 47"	14.0	ALS and VB
20	Karnataka	Dharward	SP-2592 (BG II) (H)	15° 27' 36"	75° 02' 47"	21.0	ALS, VB, PB and BA
21	Tamil Nadu	Coimbatore	Surabhi (V)	11° 00' 54"	76° 55' 41"	6.0	ALS
22	Tamil Nadu	Coimbatore	TCH - 1075 (V)	11° 01' 12"	76° 55' 48"	5.0	ALS
23	Tamil Nadu	Coimbatore	DCH -32 (V)	11° 01' 12"	76° 55' 48"	7.0	ALS and VB
24	Tamil Nadu	Coimbatore	Suraj (V)	11° 00' 54"	76° 55' 41"	12.0	ALS and VB
25	Tamil Nadu	Coimbatore	BGDS-1063 (V)	11° 01' 09"	76° 55' 49"	11.0	ALS, VB and PB
26	Tamil Nadu	Coimbatore	LRK 516 (V)	11° 00' 54"	76° 55' 41"	11.0	ALS and VB
27	Tamil Nadu	Dindigul	RCH 659 BG II (H)	10° 23' 23"	77° 49' 33"	3.0	ALS
28	Tamil Nadu	Dindigul	Jackpot (Bioseed) (H)	10° 25' 06"	77° 48' 46"	5.0	ALS
29	Andhra Pradesh	Kurnool	RCH 659 BG II (H)	15° 27' 05"	78° 36' 17"	14.0	ALS and VB
30	Andhra Pradesh	Guntur	Darya Bt (H)	16° 24' 08"	80° 25' 54"	7.0	ALS
31	Andhra Pradesh	Guntur	RCH 659 BG II (H)	16° 28' 11"	80° 20' 02"	11.0	ALS and VB
32	Telangana	Warangal	RCH 659 BG II (H)	18° 02' 49"	79° 38' 34"	12.0	ALS and VB
33	Telangana	Warangal	Bindass BG II (Bioseed) (H)	18° 03' 55"	79° 41' 32"	8.0	ALS
34	Telangana	Hyderabad	Variety	17° 32' 19"	78° 41' 96"	15.0	ALS, VB and PB

PDI- Per cent Disease Index; ALS- Angular Leaf Spot; VB- Vein Blight; PB- Petiole Blight; BA- Black Arm; BR- Boll Rot

**ACKNOWLEDGEMENTS**

We acknowledge the support given by the Director, ICAR-Central Institute for Cotton Research, Nagpur, Professor and Head, Department of Plant Pathology and Dean (SPGS), Tamil Nadu Agricultural University, Coimbatore.

**REFERENCES**

- Anonymous (2013-2018).** "Annual Report" All India Coordinated Research Project on Cotton, Coimbatore.
- Essenberg, M., Bayles, M. B., Pierce, M. L. and Verhalen, L. M. 2014.** Pyramiding B genes in cotton achieves broader, but not always higher, resistance to bacterial blight. *Phytopathol.* **104**: 1088-97.
- Jagtap, G. P., Jangam, A. M., Utpal, D. 2012.** Survey for incidence and severity of bacterial blight of cotton caused by *Xanthomonas axonopodis* pv. *malvacearum* in different districts of Marathwada region. *Scientific J. Biol. Sci.* **1** : 8-12.
- Jalloul, A., Sayegh, M., Champion, A. and Nicole, M. 2015.** Bacterial blight of cotton. *Phytopathol. Mediterr.* **54** : 3-20.
- Madani, A. S., Marefat, A., Behboudi, K. and Ghasemi, A. 2010.** Phenotypic and genetic characteristics of *Xanthomonas citri* subsp. *malvacearum*, causal agent of cotton blight, and identification of races in Iran. *Australas. Pl. Pathol.* **39**: 440-45.
- Sandipan, P. B., Bhanderi, G. R., Patel, R. D., Desai, H. R. and Solanki, B. G. 2016.** Survey and occurrence of different diseases of cotton in cultivators' and farmers field under South Gujarat condition. *Internat. J. Plant Sci.* **11** : 278-81.
- Sheo Raj, 1988.** *Grading for Cotton Diseases*. Bull., Central Institute for Cotton Research, Nagpur, India, pp 1-7.

---

**Received for publication : September 22, 2018**

**Accepted for publication : December 10, 2018**